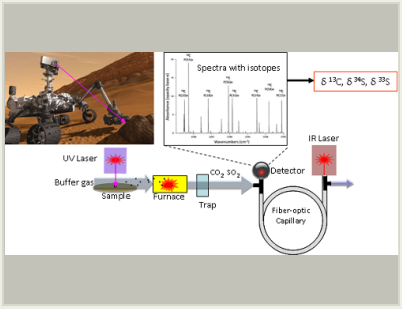
Compact Isotope Analysis System for In-Situ Biosignature Investigation, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

We propose to develop a sensor for in-situ stable isotope analysis from a lander/rover on future planetary missions. The system will enable the collection of valuable information applicable to biosignature investigations, i.e., the search for evidence of life within the solar system. Current limitations to in-situ isotope measurements will be overcome by utilizing a hollow fiber optic based IR spectroscopy concept. This concept enables high precision measurements within the ultra-small sample volume (<<1ml) of the hollow fiber and has proven to be three orders of magnitude more sensitive in terms of required sample size than current state of the art isotope sensors. The proposed project will focus on transitioning the current lab-based technique to a small size, weight, and power (SWaP) device that can be operated unattended. Significant strides will be made in this direction through the use of optimized hollow fiber technology developed at OKSI. In Phase I, proposed concepts for improving the system performance, reducing the SWaP, and engineering a field-capable device will be proven and specific options down selected for full development in Phase II. A complete prototype will be produced to measure Carbon (C) and Sulfur (S) isotope ratios from solid rock samples in Phase II. The ability to generate simultaneous C and S isotope measurements from solid samples has great potential for assessing biosignatures relating to sulfate reducing organisms and organisms using simple C substrates (including methanogens, fermenters, and others). The sensitivity afforded by the proposed system would open up this capability to smaller samples than ever before measured as well as provide a potential device for remote deployment. This could be a significant development in the search for these biosignatures on other planets and near space objects as well as in the early Earth rock record.



Compact isotope analysis system for in-situ biosignature investigation Project Image

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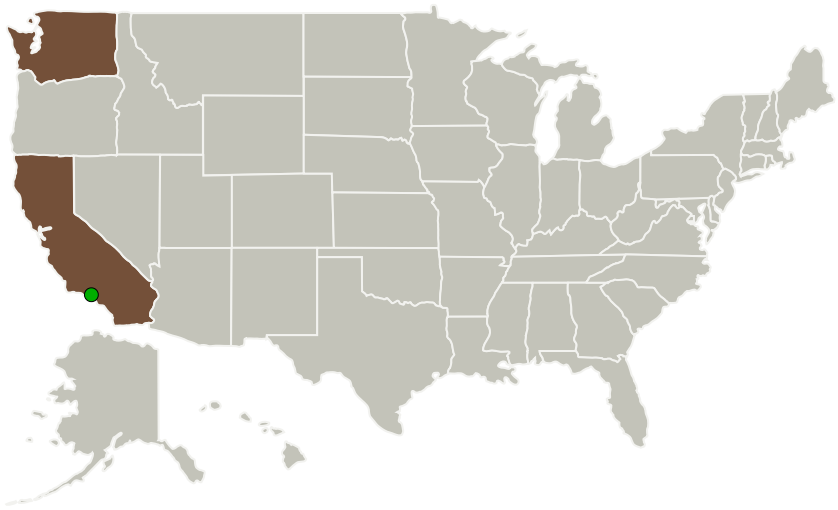
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Opto-Knowledge Systems, Inc.(OKSI)	Lead Organization	Industry	Torrance, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
Pacific Northwest National Laboratory(PNNL)	Supporting Organization	R&D Center	Richland, Washington

Primary U.S. Work Locations	
California	Washington

Project Transitions

June 2014: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Opto-Knowledge Systems, Inc. (OKSI)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

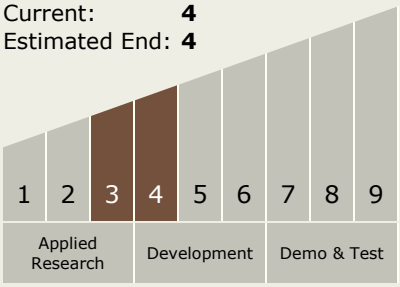
Carlos Torrez

Principal Investigator:

Jason M Kriesel

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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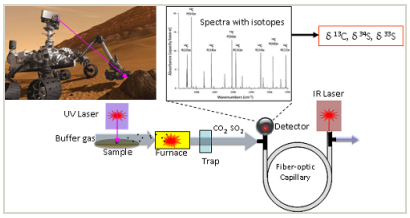
December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140749)*

Images



Project Image
Compact isotope analysis system for in-situ biosignature investigation Project Image *(https://techport.nasa.gov/image/135597)*

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System